Abstract Submitted
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A theoretical model of electrophoretic biomolecule separation in periodic nanofilter arrays[1] ZI RUI LI, NUS, NICOLAS HADJICONSTANTINOU, MIT, GUI RONG LIU, NUS, JONGYOON HAN, MIT, YU ZONG CHEN, JIAN-SHENG WANG, NUS — We present a theoretical model describing Ogston sieving—pore size comparable to or larger than the characteristic molecular dimension—of rigid isotropic and anisotropic biomolecules in nanofluidic filters, comprising of a periodic array of alternating deep and shallow regions. We obtain one-dimensional analytical results and two-dimensional numerical solutions of a drift-diffusion description, which captures the interplay between the driving electric force, entropic barrier and molecular diffusion. The analytical solution yields explicit results for the effective mobility and trapping time, and shows that the configurational entropy, which arises from the reduction of available configurations in the confined space of the nanochannel, dominates the resulting separation behavior. Our results are in line with experimental observations, and elucidate the effects of field strength, device geometry and entropic barrier height, providing a robust tool for the design and optimization of nanofilter/nanopore systems.

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